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COMPARISON OF
MIF, MANUAL RESERVES AND AVF

STUDY REPORT

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PURPOSE OF STUDY

The ultimate goal of this exercise was to find out whether the MIF or the manual reserves more accurately described the reality. In other words, our purpose was to compare the validity of the MIF and the manual reserves.

METHOD OF STUDY

a) Underlying Theory

The MIF and manual reserves were treated as two mathematical models of the real life situation. Thus, if we could find the relationship between each model and the real life situation, then we could compare the models. However, the real life situation was actually an unknown, therefore, the AVF, which was the closest approximation available, was assumed to represent the real life situation. For our purpose, it was sufficient to obtain a linear equation for each model using AVF values as the independent variable. As the metal contents were our point of interest, linear regression analysis on comparable metal contents would be the method we employed. ✓

b) Procedure

o Comparable manual MIF and AVF values for sections 62W, 64W and 66W (of Population 22 and 25) were obtained. AVF values for both large and small blocks were obtained and used.

o As the MIF and manual reserves for the range below 4% were not available, and the AVF did not give any information about tonnage, all three sets of data were treated to give Y-value that was defined as follows:

$$Y = \text{grade} \times \text{percentage of the } +4\% \text{ population}$$

We can see that Y was related to the metal content and the relationship is clearly seen in the following equation:

$$\text{Metal Content} = Y \times \text{tonnage for } +4\% \text{ population}$$

o Five linear regression analyses were done using a general purpose statistical program for:

- | | |
|---|---|
| 1. Independent variable = AVF (small block) | x |
| Dependent variable = MIF | y |

2. Independent variable = AVF (small block) $\times$
Dependent variable = Manual reserves γ
3. Independent variable = AVF (large block) $\times$
Dependent variable = MIF γ
4. Independent variable = AVF (large block) $\times$
Dependent variable = Manual reserves γ
5. Independent variable = MIF $\times$
Dependent variable = Manual reserves γ

- o A graph of the regression lines was drawn and the correlation coefficients were noted.

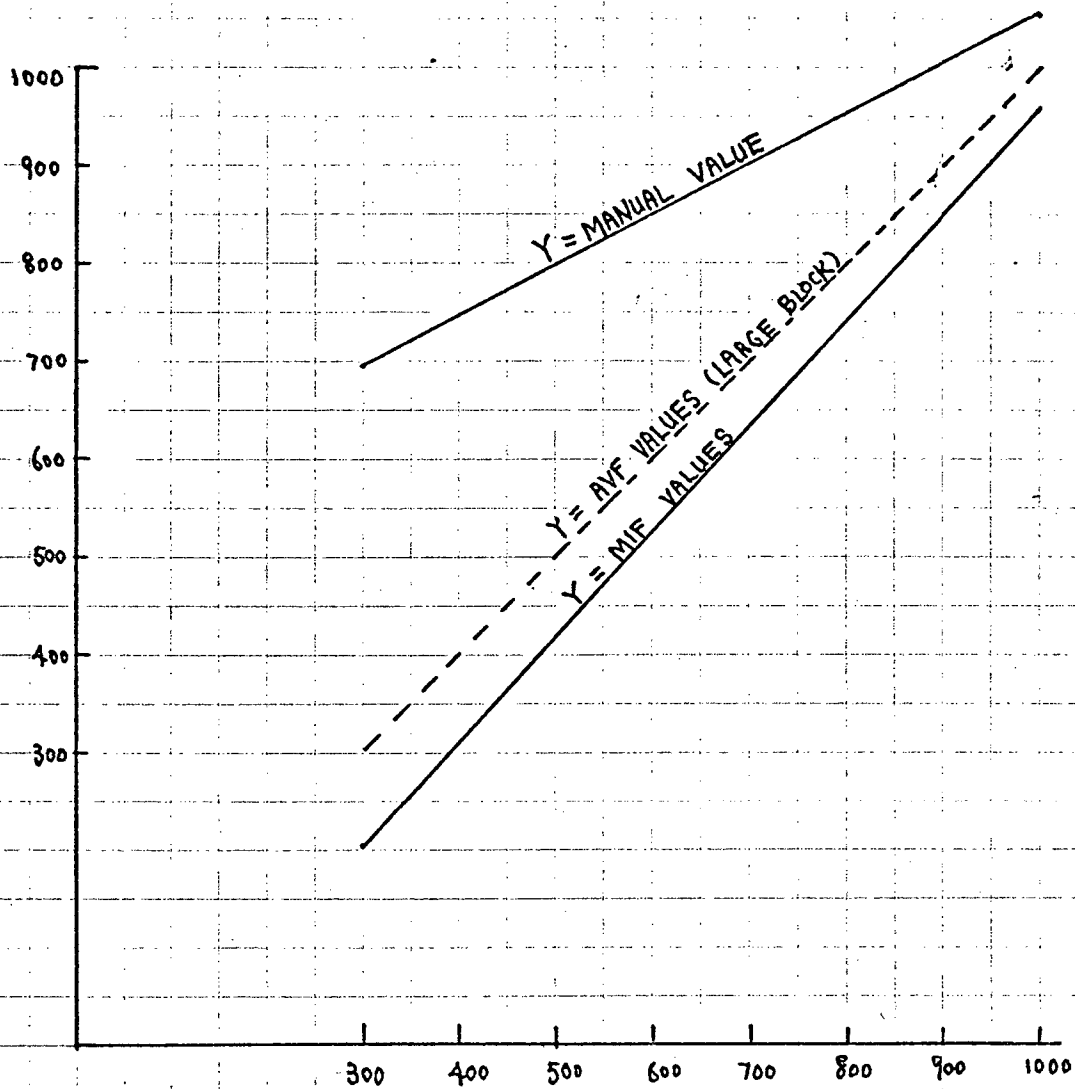
RESULTS

For detailed information, please refer to the Appendices. The following chart is a summary of the results:

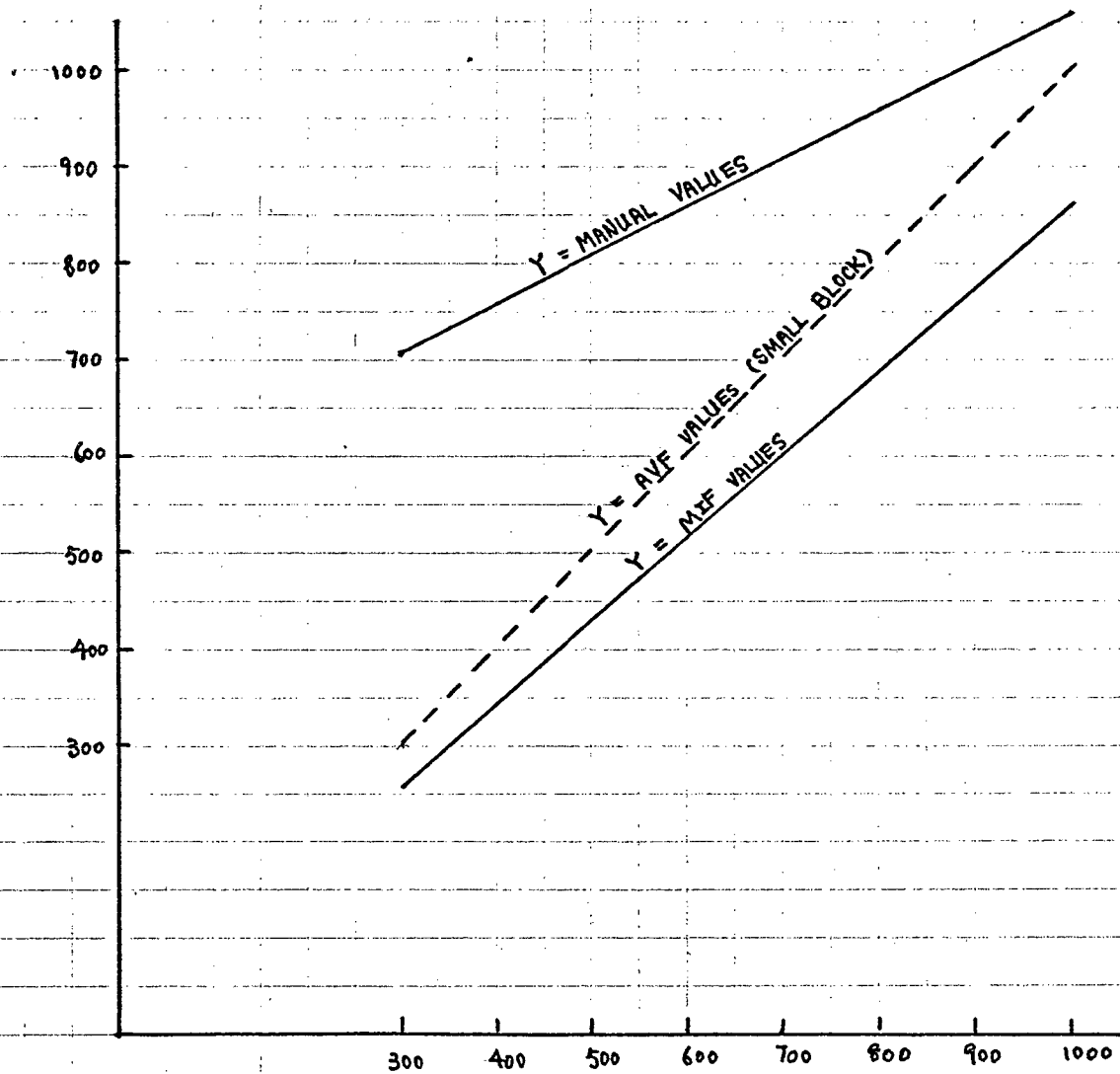
	X = AVF (large blocks)	X = AVF (small blocks)	X = MIF
Y = MIF	r = 0.85 ① Y = 115.22+1.07X	r = 0.68 ② Y = 19.54+0.79X	—
Y = Manual	r = 0.54 Y = 544.41+0.51X	r = 0.53 Y = 576.14+0.43X	r = 0.59 Y = 533.10+0.55X

The regression lines were plotted in the following pages.

- ① Very strong correlation which isn't too surprising. Also $y = \text{MIF}$ values are generated from large blocks.
- ② Correlation reduced - presumably because AVF is based on small blocks, then compiled into large blocks for MIF estimate.



MIF VS. AVF (LARGE BLOCK)
MANUAL



MIF VS. AVF (SMALL BLOCK)
MANUAL

CONCLUSION

From the graphs and the correlation coefficients, we can conclude that the MIF values are closer to the AVF values than the manual reserves to the AVF values. Thus, if our assumption that the AVF values represent the real life situation, the MIF is a more realistic model than the manual reserves. Note also, that the MIF values are closer to the large block AVF than to the small block AVF.

APPENDICES

- o Computer Printout
- o Worksheets

*** FOR X = AVF(LARGE BLOCKS) Y = MIF

NUMBER OF PAIRS OF VALUES PROCESSED = 15
SLOPE= 1.0669460

Y INTERCEPT= -115.2231445

MEAN OF X= 641.2355957

MEAN OF Y= 568.9404297

STANDARD DEVIATION OF X= 175.9099426

STANDARD DEVIATION OF Y= 219.6955566

CORRELATION COEFFICIENT= 0.8543016

*** Y = -115.2231445 + 1.0669460*X ***

INPUT VALUES AND RESIDUALS

<u>INPUT X</u>	<u>INPUT Y</u>	<u>RESIDUAL</u>
611	336	-200.4895
610	719	182.8762
553	633	158.5954
426	188	-151.1968
512	562	131.4682
392	409	105.6281
862	903	98.5158
468	291	-92.3212
611	473	-63.7495
673	543	-59.8127
524	393	-51.5864
972	766	-49.1535
935	902	-33.7185
807	764	18.3383
713	652	6.6013

*** FOR X = AVF(LARGE BLOCKS) Y = MANUAL

NUMBER OF PAIRS OF VALUES PROCESSED = 12

SLOPE= 0.5096085

Y INTERCEPT= 544.4050293

MEAN OF X= 676.1479492

MEAN OF Y= 888.9755859

STANDARD DEVIATION OF X= 176.1259918

STANDARD DEVIATION OF Y= 167.2173309

CORRELATION COEFFICIENT= 0.5367345

*** Y = 544.4050293 + 0.5096085*X ***

INPUT VALUES AND RESIDUALS

INPUT X	INPUT Y	RESIDUAL
611	561	-294.6418
713	716	-191.8178
872	1135	146.2165
862	1108	124.3125
807	833	-122.7038
524	933	121.3674
673	1005	117.7878
610	960	104.5173
985	995	-51.3693
512	833	27.9521
553	848	22.2971
392	740	-3.9133

*** X = AVF Y = MIF (SMALL) ***

NUMBER OF PAIRS OF VALUE PROCESSED = 15
 SLOPE= 0.7897374
 Y INTERCEPT= 19.5439453
 MEAN OF X= 695.6699219
 MEAN OF Y= 568.9404297
 STANDARD DEVIATION OF X= 189.3006744
 STANDARD DEVIATION OF Y= 219.6955566
 CORRELATION COEFFICIENT= 0.6804736
 *** Y = 19.5439453 + 0.7897374*X ***

INPUT VALUES AND RESIDUALS

<u>INPUT X</u>	<u>INPUT Y</u>	<u>RESIDUAL</u>
1036	902	64.2883
968	766	-18.0095
897	764	36.5075
853	903	209.8100
786	543	-98.0256
766	652	27.1154
696	393	-176.8164
663	473	-70.1013
663	336	-206.8413
604	719	222.2390
594	291	-156.8908
533	633	193.0634
530	188	-250.1505
493	562	153.2580
353	409	110.5502

*** X = AVF Y = MANUAL (SMALL) ***

NUMBER OF PAIRS OF VALUE PROCESSED = 12
SLOPE= 0.4340829
Y INTERCEPT= 576.1359863
MEAN OF X= 720.6914063
MEAN OF Y= 888.9755959
STANDARD DEVIATION OF X= 203.4451752
STANDARD DEVIATION OF Y= 167.2173309
CORRELATION COEFFICIENT= 0.5281122
*** Y = 576.1359863 + 0.4340829*X ***

INPUT VALUES AND RESIDUALS

<u>INPUT_X</u>	<u>INPUT_Y</u>	<u>RESIDUAL</u>
1036	995	-30.8457
968	1135	138.6718
897	833	-132.3845
853	1108	161.5913
786	1005	87.4455
766	716	-192.9633
696	933	54.5895
663	561	-302.7502
604	960	121.6113
533	848	41.0964
493	833	42.9426
353	740	11.0000

*** X = MIP Y = MANUAL ***

NUMBER OF PAIRS OF VALUE PROCESSED = 12
 SLOPE= 0.5532923
 Y INTERCEPT= 533.1027832
 MEAN OF X= 643.1914063
 MEAN OF Y= 888.9755859
 STANDARD DEVIATION OF X= 174.0901794
 STANDARD DEVIATION OF Y= 167.2173309
 CORRELATION COEFFICIENT= 0.5760360
 *** Y = 533.1027832 + 0.5532923*X ***

INPUT VALUES AND RESIDUALS

<u>INPUT X</u>	<u>INPUT Y</u>	<u>RESIDUAL</u>
903	1108	75.2744
902	995	-37.1723
766	1135	178.0754
764	833	-122.9399
719	960	29.1337
652	716	-177.9475
633	848	-35.0346
562	833	-11.0510
543	1005	171.6430
473	561	-233.6486
409	740	-18.9606
393	933	182.6403

DATA FOR REGRESSION ANALYSIS

(see worksheet #1, #2, #3, #4 for derivation)

[illegible]

ASSAY x % FOR MANUAL VALUES

SECT	RANGE	TONNAGE	% of +4%	PB ASSAY	ZN ASSAY	ASSAY(Pb+Zn)	ASSAY x %
62	+4%	630,266	100%	3.94	6.01	9.95	995
	+6%	414,027	65.69%	4.71	7.97	12.68	832.95
	+8%	301,933	47.91%	5.30	9.64	14.94	715.78
	+10%	192,205	30.50%	6.27	12.13	18.40	561.20
64	+4%	1,164,762	100%	4.34	6.74	11.08	1108
	+6%	822,652	70.63%	5.23	8.36	13.59	959.86
	+8%	635,121	54.53%	5.89	9.67	15.56	848.49
	+10%	613,866	52.70%	5.98	9.83	15.81	833.19
	+12%	520,425	44.68%	6.19	10.38	16.57	740.35
66	+4%	1,377,821	100%	4.80	6.55	11.35	1135
	+6%	1,022,596	74.22%	5.77	7.77	13.54	1004.94
	+8%	878,670	63.77%	6.22	8.41	14.63	932.96

WORK SHEET #2

ASSAY x % FOR MIF

TEST	RANGE	TONNAGE	% of +4%	Pb ASSAY	Zn ASSAY	ASSAY(Pb+Zn)	ASSAY x %
62	+4%	410,290	100%	3.29	5.73	9.02	902
	+6%	291,109	70.95%	3.85	6.92	10.77	764.13
	+8%	225,300	54.91%	4.23	7.64	11.87	651.78
	+10%	157,663	38.43%	4.67	8.45	12.31	473.07
	+12%	95,782	23.34%	5.17	9.24	14.41	336.33
64	4	943,771	100%	3.49	5.54	9.03	903
	6	585,735	62.06%	4.27	7.31	11.58	718.65
	8	467,017	49.48%	4.64	8.16	12.80	633.34
	10	394,581	41.81%	4.79	8.66	13.45	562.34
	12	262,881	27.85%	5.11	9.57	14.68	408.84
66	4	1,158,432	100%	3.24	4.42	7.66	766
	6	643,990	55.59%	4.08	5.68	9.76	542.56
	8	390,027	33.67%	4.87	6.79	11.66	392.59
	10	259,882	22.43%	5.38	7.61	12.99	291.37
	12	149,727	12.92%	6.00	8.56	14.56	188.12

WORK SHEET #3

ASSAY x % FOR AVE (SMALL BLOCK)

TEST	RANGE	% of total	% of +4%	Pb ASSAY	Zn ASSAY	ASSAY(Pb+Zn)	ASSAY x %
62	+4%	23.9547%	100 %			10.36	1036
	+6%	16.6367%	69.45%			12.91	896.60
	+8%	12.1466%	50.71%			15.11	766.23
	+10%	9.4596%	39.49%			16.79	663.04
	+12%	9.4596%	39.49%			16.79	663.04
64	+4%	37.7455%	100 %			8.53	853
	+6%	18.3068%	48.50%			12.45	603.83
	+8%	14.2096%	37.65%			14.15	532.75
	+10%	12.5886%	33.35%			14.79	493.25
	+12%	7.8312%	20.75%			17.01	352.96
66	+4%	36.4118%	100 %			9.68	968
	+6%	23.1088%	63.47%			12.39	786.39
	+8%	18.3825%	50.49%			13.79	696.26
	+10%	14.0526%	38.59%			15.38	593.51
	+12%	11.9466%	32.81%			16.16	530.21

WORKSHEET #4

ASSAY x % FOR AVE (LARGE BLOCK)

SECT	RANGE	% of total	% of +4%	Pb ASSAY	Zn ASSAY	ASSAY(Pb+Zn)	ASSAY x %
62	+4%	24.3922%	100%			9.85	985
	+6%	14.6134%	59.91%			13.47	806.99
	+8%	11.4586%	46.98%			15.17	712.69
	+10%	8.7738%	35.97%			16.99	611.13
	+12%	8.7738%	35.97%			16.99	611.13
64	+4%	36.4386%	100%			8.62	862
	+6%	17.4644%	47.93%			12.73	610.15
	+8%	14.2307%	39.05%			14.16	552.95
	+10%	12.5946%	34.56%			14.81	511.83
	+12%	8.6501%	23.74%			16.52	392.18
66	+4%	34.8489%	100%			8.72	872
	+6%	21.3645%	61.31%			10.97	672.57
	+8%	13.9507%	39.75%			13.19	524.30
	+10%	11.5488%	33.14%			14.11	467.61
	+12%	10.2107%	29.30%			14.54	426.02